

What is claimed is:

1. A method of controlling an induction generator, said method comprising the steps of:

5 measuring a plurality of current amounts in the generator using a plurality of current sensors;

transforming the plurality of current amounts into a two phase reference system;

10 measuring a DC voltage supplied to an inverter, the inverter being operatively connected to the generator;

measuring a plurality of voltage amounts in the generator using a plurality of voltage sensors;

transforming the plurality of voltage amounts into the two phase reference system;

15 calculating a flux in the generator using the currents and the voltages obtained by said steps of transforming so as to obtain a magnitude and position of the flux;

comparing the calculated flux magnitude with a desired flux to determine a flux error amount, the flux error amount

20 being input to a flux regulator;

determining a d-axis voltage so as to reduce the flux error amount;

comparing a desired DC voltage with the measured DC voltage to determine a voltage error amount, the voltage error 25 amount being input to a voltage regulator;

determining a desired torque amount so as to reduce the voltage error amount;

comparing the desired torque amount with an estimated torque amount to determine a torque error amount, the torque error amount being input to a torque regulator;

determining a q-axis voltage so as to reduce a torque error amount; and

transforming the d-axis voltage and the q-axis voltage to stationary reference frame, n-phase voltages using the 10 position of the flux, wherein n is substantially equal to a number of generator phases.

2. A method as defined in claim 1, wherein said step of calculating a flux in the generator using the currents and the voltages obtained by said steps of transforming so as to obtain a magnitude and position of the flux, will result in obtaining a stator flux in the generator.

3. A method as defined in claim 2, further comprising
20 the steps of using the stator flux magnitude in said step of
comparing the calculated flux magnitude with a desired flux;
and

using the stator flux position in said step of transforming the d-axis voltage and the q-axis voltage to stationary reference frame n-phase voltages using the position

of the flux, wherein n is substantially equal to a number of generator phases.

4. A method as defined in claim 2, further comprising
5 the steps of calculating a rotor flux in the generator using calculated stator flux in the two phase reference frame so as to obtain a magnitude and position of the rotor flux;

using the rotor flux magnitude said step of comparing the calculated flux magnitude with a desired flux; and

10 using the rotor flux position in said step of transforming the d-axis voltage and the q-axis voltage to stationary reference frame voltages n-phase voltages using the position of the flux, wherein n is substantially equal to a number of generator phases.

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5. A method as defined in claim 1, further comprising the steps of:

determining the desired torque amount by selectively switching between 1) said steps of comparing a desired DC
20 voltage with the measured DC voltage to determine a voltage error amount and determining a desired torque amount, as an output of the voltage regulator, so as to reduce the voltage error amount; and

25 2) obtaining a desired generator shaft torque amount and converting the desired generator shaft torque amount to the desired torque amount by a mapping function.

6. A method of controlling an induction generator, said method comprising the steps of:

- measuring a plurality of current amounts in the generator
- 5 using a plurality of current sensors;
- transforming the plurality of current amounts into a two phase reference system;
- measuring a DC voltage supplied to an inverter, the inverter being operatively connected to the generator;
- 10 measuring a plurality of voltage amounts in the generator using a plurality of voltage sensors;
- transforming the plurality of voltage amounts into the two phase reference system;
- calculating a flux in the generator using the currents
- 15 and the voltages obtained by said steps of transforming so as to obtain a magnitude and position of the flux;
- comparing the calculated flux magnitude with a desired flux to determine a flux error amount, the flux error amount being input to a flux regulator;
- 20 determining a d-axis voltage so as to reduce the flux error amount;
- determining a desired torque amount by obtaining a desired generator shaft torque amount and converting the desired generator shaft torque amount to the desired torque
- 25 amount by a mapping function;

comparing the desired torque amount with an estimated torque amount to determine a torque error amount, the torque error amount being input to a torque regulator;

5 determining a q-axis voltage so as to reduce a torque error amount; and

transforming the d-axis voltage and the q-axis voltage to stationary reference frame n-phase voltages using the position of the flux, wherein n is substantially equal to a number of generator phases.

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7. A method as defined in claim 6, further comprising the steps of:

determining the desired torque amount by selectively switching between 1) said step of determining the desired 15 torque amount by obtaining a desired generator shaft torque amount and converting the generator shaft torque amount to the desired torque amount by a mapping function; and 2) comparing a desired DC voltage with the measured DC voltage to determine a voltage error amount and determining 20 the desired torque amount, as an output of a voltage regulator, so as to reduce the voltage error amount.

8. A method as defined in claim 6, wherein said step of calculating a flux in the generator using the currents and the 25 voltages obtained by said steps of transforming so as to

obtain a magnitude and position of the flux, will result in obtaining a stator flux in the generator.

9. A method as defined in claim 8, further comprising
5 the steps of using the stator flux magnitude in said step of comparing the calculated flux magnitude with a desired flux; and

using the stator flux position in said step of transforming the d-axis voltage and the q-axis voltage to
10 stationary reference frame n-phase voltages using the position of the flux, wherein n is substantially equal to a number of generator phases.

10. A method as defined in claim 8, further comprising
15 the steps of calculating a rotor flux in the generator using calculated stator flux magnitudes in the two phase reference frame so as to obtain a magnitude and position of the rotor flux;

using the rotor flux magnitude said step of comparing the
20 calculated flux magnitude with a desired flux; and

using the rotor flux position in said step of transforming the d-axis voltage and the q-axis voltage to stationary reference frame n-phase voltages using the position of the flux, wherein n is substantially equal to a number of generator phases.

11. A method of controlling an induction generator, said method comprising the steps of:

measuring a plurality of current amounts in the generator using a plurality of current sensors;

5 transforming the plurality of current amounts into a two phase reference system;

measuring a DC voltage supplied to an inverter, the inverter being operatively connected to the generator;

10 obtaining a desired d-axis voltage and a desired q-axis voltage;

transforming the desired d-axis voltage and the desired q-axis voltage into the two phase stationary reference system using a generator flux position;

15 calculating a flux in the generator using the currents and the voltages obtained by said steps of transforming so as to obtain a magnitude and position of the flux;

comparing the calculated flux magnitude with a desired flux to determine a flux error amount, the flux error amount being input to a flux regulator;

20 determining a new d-axis voltage so as to reduce the flux error amount;

comparing a desired DC voltage with the measured DC voltage to determine a voltage error amount, the voltage error amount being input to a voltage regulator;

25 determining a desired torque amount so as to reduce the voltage error amount;

comparing the desired torque amount with an estimated torque amount to determine a torque error amount, the torque error amount being input to a torque regulator;
determining a new q-axis voltage so as to reduce a torque
5 error amount; and

transforming the new d-axis voltage and the new q-axis voltage to stationary reference frame n-phase voltages using the position of the flux, wherein n is substantially equal to a number of generator phases.

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12. A method as defined in claim 11, further comprising the steps of:

determining the desired torque amount by selectively switching between 1) said steps of comparing a desired DC
15 voltage with the measured DC voltage to determine a voltage error amount and determining a desired torque amount, as an output of the voltage regulator, so as to reduce the voltage error amount; and

2) obtaining a desired generator shaft torque amount and
20 converting the desired generator shaft torque amount to the desired torque amount by a mapping function.

13. A method as defined in claim 11, wherein said step of calculating a flux in the generator using the currents and
25 the voltages obtained by said steps of transforming so as to

obtain a magnitude and position of the flux, will result in obtaining a stator flux in the generator.

14. A method as defined in claim 13, further comprising
5 the steps of using the stator flux magnitude in said step of
comparing the calculated flux magnitude with a desired flux;
and

using the stator flux position in said step of
transforming the d-axis voltage and the q-axis voltage to
10 stationary reference frame n-phase voltages using the position
of the flux, wherein n is substantially equal to a number of
generator phases.

15. A method as defined in claim 13, further comprising
15 the steps of calculating a rotor flux in the generator using
calculated stator flux in the two phase reference frame so as
to obtain a magnitude and position of the rotor flux;

using the rotor flux magnitude said step of comparing the
calculated flux magnitude with a desired flux; and

20 using the rotor flux position in said step of
transforming the d-axis voltage and the q-axis voltage to
stationary reference frame n-phase voltages using the position
of the flux, wherein n is substantially equal to a number of
generator phases.

16. A method of controlling an induction generator, said method comprising the steps of:

measuring a plurality of current amounts in the generator using a plurality of current sensors;

5 transforming the plurality of current amounts into a two phase reference system;

measuring a DC voltage supplied to an inverter, the inverter being operatively connected to the generator;

10 obtaining a desired d-axis voltage and a desired q-axis voltage;

transforming the desired d-axis voltage and the desired q-axis voltage into the two phase stationary reference system;

15 calculating a flux in the generator using the currents and the voltages obtained by said steps of transforming so as to obtain a magnitude and position of the flux;

comparing the calculated flux magnitude with a desired flux to determine a flux error amount, the flux error amount being input to a flux regulator;

20 determining a new d-axis voltage so as to reduce the flux error amount;

determining a desired torque amount by obtaining a desired generator shaft torque amount and converting the generator shaft torque amount to the desired torque amount by a mapping function;

comparing the desired torque amount with an estimated torque amount to determine a torque error amount, the torque error amount being input to a torque regulator;

5 determining a new q-axis voltage so as to reduce a torque error amount; and

transforming the new d-axis voltage and the new q-axis voltage to stationary reference frame n-phase voltages using the position of the flux, wherein n is substantially equal to a number of generator phases.

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17. A method as defined in claim 16, further comprising the steps of:

determining the desired torque amount by selectively switching between 1) said step of determining the desired 15 torque amount by obtaining a desired generator shaft torque amount and converting the generator shaft torque amount to the desired torque amount by a mapping function; and

2) comparing a desired DC voltage with the measured DC voltage to determine a voltage error amount and determining 20 the desired torque amount, as an output of a voltage regulator, so as to reduce the voltage error amount.

18. A method as defined in claim 16, wherein said step of calculating a flux in the generator using the currents and the 25 voltages obtained by said steps of transforming so as to

obtain a magnitude and position of the flux, will result in obtaining a stator flux in the generator.

19. A method as defined in claim 18, further comprising
5 the steps of using the stator flux magnitude in said step of
comparing the calculated flux magnitude with a desired flux;
and

using the stator flux position in said step of
transforming the d-axis voltage and the q-axis voltage to
10 stationary reference frame n-phase voltages using the position
of the flux, wherein n is substantially equal to a number of
generator phases.

20. A method as defined in claim 18, further comprising
15 the steps of calculating a rotor flux in the generator using
calculated stator flux in the two phase reference frame so as
to obtain a magnitude and position of the rotor flux;

using the rotor flux magnitude said step of comparing the
calculated flux magnitude with a desired flux; and

20 using the rotor flux position in said step of
transforming the d-axis voltage and the q-axis voltage to
stationary reference frame n-phase voltages using the position
of the flux, wherein n is substantially equal to a number of
generator phases.